

Claims

1. A device for the galvanic surface treatment of work pieces comprising:

a holder for receiving a work piece, said holder comprising a least a first part and a second part;

means for moving at least one of said first and second parts relative to another one of said first and second parts between an open position and a closed position, allowing an insertion and removal of said work piece between said first and second parts when being in said open position and forming a closed process chamber comprising at least one exposed surface of said work piece to be treated when being in said closed position;

a plurality of inlet openings provided within said holder for feeding process fluid into said process chamber;

a plurality of outlet openings provided within said holder for removing process fluid from said process chamber;

at least one electrode arranged in fluid communication with said process chamber and having at least one surface exposed toward said process chamber;

means for connecting said electrode to one pole of a DC power source;

means for connecting said work piece to another pole of said DC power source;

a fluid pump for generating a flow of process fluid through said process chamber along a surface of said work piece to be treated;

wherein said inlet openings and outlet openings are arranged in a pattern formed by alternating inlet openings and outlet openings yielding into said closed process chamber.

2. A device for the galvanic surface treatment of work pieces comprising:

a holder for receiving a work piece, said holder comprising a least a first part and a second part;

means for moving at least one of said first and second parts relative to another one of said first and second parts between an open position and a closed position, allowing an insertion and removal of said work piece between said first and second parts when being in said open position and forming a closed process chamber comprising at least one exposed surface of said work piece to be treated when being in said closed position;

a plurality of inlet openings provided within said holder for feeding process fluid into said process chamber;

a plurality of outlet openings provided within said holder for removing process fluid from said process chamber;

at least one electrode arranged in fluid communication with said process chamber and having at least one surface exposed toward said process chamber;

means for connecting said electrode to one pole of a DC power source;

means for connecting said work piece to another pole of said DC power source;

a fluid pump for generating a flow of process fluid through said process chamber along a surface of said work piece to be treated;

wherein said inlet openings and outlet openings are arranged in a pattern formed by alternating groups of inlet openings and outlet openings yielding into said closed process chamber.

3. A device for the galvanic surface treatment of work pieces comprising:

a holder for receiving a work piece having a cavity comprising at least one surface to be treated, said holder comprising at least a first part and a second part;

means for moving at least one of said first and second parts relative to another one of said first and second parts between an open position and a closed position, allowing an insertion and removal of said work piece into and out of said holder when being in said open position and forming a closed process chamber comprising at least one exposed surface of said work piece to be treated when being in said closed position;

a tube protruding through one of said first and second parts into said cavity and forming said process chamber at least between said exposed surface of said work piece and an outer surface of said tube, said tube comprising at least one electrically conductive part, at least one feed channel and at least one drain channel extending longitudinally therein;

a plurality of inlet openings provided within an outer surface of said tube and communicating with said feed channel for feeding process fluid into said process chamber;

a plurality of outlet openings provided within said outer surface of said tube and communicating with said drain channel for removing process fluid from said process chamber;

means for connecting said electrically conductive part of said tube to one pole of a DC power source;

means for connecting said work piece to another pole of said DC power source;

a fluid pump for generating a flow of process fluid through said process chamber along a surface of said work piece to be treated;

wherein said inlet openings and outlet openings are arranged within a pattern formed by alternating groups of inlet openings and outlet openings.

4. The device of claim 3, wherein said tube comprises a wall extending longitudinally therein and dividing said tube into said feed channel and into said drain channel.

5. The device of claim 3, further comprising gas passages extending between said feed channel and said drain channel.

6. The device of claim 3, further comprising a cover made of insulating material enclosing said tube.

7. The device of claim 3, wherein said inlet openings and said outlet openings have a cross section selected from the group formed by circular, elliptical, oval and rectangular.

8. The device of claim 1, wherein said first and second parts comprise surfaces shaped for resting against end surfaces of said work piece for clamping said work piece there between.

9. The device of claim 8, further comprising a mask surrounding an outer surface of said work piece, wherein said process chamber is formed at least between an outer surface of said work piece and a surface of said mask facing said work piece.

10. The device of claim 9, wherein said inlet and outlet openings are connected to feed and drain channels extending through said mask.

11. The device of claim 9, wherein said mask further comprises an electrode arranged radially distant from said work piece.

12. The device of claim 11, wherein said inlet and outlet openings are connected to feed and drain channels extending through said electrode.

13. The device of claim 9, further comprising first and second intermediate rings resting against said first and second parts and enclosing said mask at a top and bottom side thereof.

14. The device of claim 10, further comprising an outer part surrounding said mask and comprising channels communicating with said feed and drain channels for feeding fluid to said inlet openings and draining fluid from said outlet openings.

15. The device of claim 1, further comprising at least one sealing for sealing said process chamber at least between said work piece, and said first and second parts.

16. The device of claim 1, wherein said inlet openings and said outlet openings have a cross section selected from the group formed by circular, elliptical, oval and rectangular.

17. The device of claim 1, wherein said electrode is arranged outside the process chamber but in fluid communication with feed channels for feeding fluid to said inlet openings.

18. The device of claim 1, wherein said inlet openings communicate with feed channels that run into the process chamber substantially perpendicularly to the surface of the work piece to be treated.

19. The device of claim 1, wherein said inlet openings communicate with feed channels that run into the process chamber at an acute angle with respect to the surface of the work piece to be treated.

20. The device of claim 19, wherein said outlet openings communicate with drain channels that extend from the process chamber substantially perpendicularly with respect to the surface of the work piece to be treated.

21. The device of claim 2, wherein said inlet openings and said outlet openings have a cross section selected from the group formed by circular, elliptical, oval and rectangular.

22. The device of claim 2, wherein said first and second parts comprises surfaces shaped for resting against end surfaces of said work piece for clamping said work piece there between.

23. The device of claim 22, further comprising a mask surrounding an outer surface of said work piece, wherein said process chamber is formed at least between an outer surface of

said work piece and a surface of said mask facing said work piece.

24. The device of claim 23, wherein said inlet and outlet openings are connected to feed and drain channels extending through said mask.

25. The device of claim 24, wherein said mask further comprises an electrode arranged radially distant from said work piece.

26. The device of claim 23, wherein said inlet and outlet openings are connected to feed and drain channels extending through said electrode.

27. The device of claim 23, further comprising first and second intermediate rings resting against said first and second parts and enclosing said mask at a top and bottom side thereof.

28. The device of claim 24, further comprising an outer part surrounding said mask and comprising channels communicating with said feed and drain channels for feeding fluid to said inlet openings and draining fluid from said outlet openings.

29. The device of claim 2, further comprising at least one sealing for sealing said process chamber at least between said work piece, and said first and second parts.

30. The device of claim 2, wherein said inlet openings and said outlet openings have a cross section selected from the group formed by circular, elliptical, oval and rectangular.

31. The device of claim 2, wherein said electrode is arranged outside the process chamber but in fluid communication with feed channels for feeding fluid to said inlet openings.

32. The device of claim 2, wherein said inlet openings communicate with feed channels that run into the process chamber substantially perpendicularly to the surface of the work piece to be treated.

33. The device of claim 2, wherein said inlet openings communicate with feed channels that run into the process chamber at an acute angle with respect to the surface of the work piece to be treated.

34. The device of claim 33, wherein said outlet openings communicate with drain channels that extend from the process chamber substantially perpendicularly with respect to the surface of the work piece to be treated.

35. The device of claim 2, wherein said inlet openings and said outlet openings have a cross section selected from the group formed by circular, elliptical, oval and rectangular.

36. A device for the galvanic surface treatment of work pieces comprising:

a holder for receiving a work piece having a cavity comprising at least one surface to be treated, said holder comprising a least a first part and a second part;

means for moving at least one of said first and second parts relative to another one of said first and second parts



between an open position and a closed position, allowing an insertion and removal of said work piece into and out of said holder when being in said open position and forming a closed process chamber comprising at least one exposed surface of said work piece to be treated when being in said closed position;

a tube protruding through one of said first and second parts into said cavity and forming said process chamber at least between said exposed surface of said work piece and an outer surface of said tube, said tube comprising at least one electrically conductive part, at least one feed channel and at least one drain channel extending longitudinally therein;

a plurality of inlet openings provided within an outer surface of said tube and communicating with said feed channel for feeding process fluid into said process chamber;

a plurality of outlet openings provided within said outer surface of said tube and communicating with said drain channel for removing process fluid from said process chamber;

means for connecting said electrically conductive part of said tube to one pole of a DC power source;

means for connecting said work piece to another pole of said DC power source;

a fluid pump for generating a flow of process fluid through said process chamber along a surface of said work piece to be treated;

wherein said inlet openings and outlet openings are arranged alternately with each other.

37. The device of claim 36, wherein said electrode is arranged radially distant from said process chamber.

38. The device of claim 36, wherein said inlet and outlet openings are connected to feed and drain channels extending through said electrode.

39. The device of claim 36, wherein said inlet and outlet openings are connected to feed and drain channels extending through said mask.

40. A device for the galvanic surface treatment of work pieces comprising:

a holder for receiving a work piece, said holder comprising a mask made of an electrically insulating material surrounding an outer surface of said work piece, and further comprising a least a first part and a second part;

means for moving at least one of said first and second parts relative to another one of said first and second parts for forming a closed process chamber when resting against said work piece and said mask,;

a plurality of inlet openings provided within said holder for feeding process fluid into said process chamber;

a plurality of outlet openings provided within said holder for removing process fluid from said process chamber;

at least one electrode arranged in fluid communication with said process chamber;

means for connecting said electrode to one pole of a DC power source;

means for connecting said work piece to another pole of said DC power source;

a fluid pump for generating a flow of process fluid through said process chamber along a surface of said work piece to be treated;

a mask made of an electrically insulating material surrounding an outer surface of said work piece;

wherein

said process chamber is formed at least between an outer surface of said work piece and a surface selected from the group formed by said mask, said electrode, said first part and said second part;

said inlet openings and outlet openings are arranged in a pattern formed by alternating inlet openings and outlet openings yielding into said process chamber and being connected to feed and drain channels extending through at least one part selected from the group formed by said mask and said electrode;

said first and second parts comprise surfaces shaped for resting against end surfaces of said work piece for clamping said work piece and said mask there between.

41. The device of claim 1 wherein said inlet and outlet openings are arranged in a common surface of said holder.

42. The device of claim 2 wherein said inlet and outlet openings are arranged in a common surface of said holder.

43. A device for the galvanic surface treatment of work pieces comprising:

a holder for receiving a work piece having a cavity comprising at least one surface to be treated, said holder comprising at least a first part and a second part;

means for moving at least one of said first and second parts relative to another one of said first and second parts between an open position and a closed position, allowing an

insertion and removal of said work piece into and out of said holder when being in said open position and forming a closed process chamber comprising at least one exposed surface of said work piece to be treated when being in said closed position;

a tube protruding through one of said first and second parts into said cavity and forming said process chamber at least between said exposed surface of said work piece and an outer surface of said tube, said tube comprising at least one electrically conductive part, at least one feed channel and at least one drain channel extending longitudinally therein;

a plurality of inlet openings provided within an outer surface of said tube and communicating with said feed channel for feeding process fluid into said process chamber;

a plurality of outlet openings provided within said outer surface of said tube and communicating with said drain channel for removing process fluid from said process chamber;

means for connecting said electrically conductive part of said tube to one pole of a DC power source;

means for connecting said work piece to another pole of said DC power source;

a fluid pump for generating a flow of process fluid through said process chamber along a surface of said work piece to be treated;

wherein said inlet openings and outlet openings are arranged within a pattern formed by alternating groups of inlet openings and outlet openings.

44. A process for the galvanic surface treatment of work pieces within a closed process chamber, comprising the following steps:

clamping the work piece within a holder for forming a closed process chamber through which process fluid is fed, wherein at least one surface of said work piece is exposed to said process chamber;

contacting said work piece and connecting with a DC power source;

arranging at least one electrode at a distance from said work piece but in fluid communication with said process chamber and connecting to an opposite pole of said DC power source;

feeding process fluid into said process chamber through a plurality of inlet openings arranged at a distance from said exposed surface of said work piece;

removing process fluid from said process chamber through a plurality of outlet openings, wherein said inlet openings and said outlet openings are arranged alternately with each other.

45. A process for the galvanic surface treatment of work pieces within a closed process chamber, comprising the following steps:

clamping the work piece within a holder for forming a closed process chamber through which process fluid is fed, wherein at least one surface of said work piece is exposed to said process chamber;

contacting said work piece and connecting with a DC power source;

arranging at least one electrode at a distance from said work piece but in fluid communication with said process chamber and connecting to an opposite pole of said DC power source;

feeding process fluid into said process chamber through a plurality of inlet openings arranged at a distance from said exposed surface of said work piece;

removing process fluid from said process chamber through a plurality of outlet openings, wherein groups of said inlet openings and said outlet openings are arranged alternately with each other.

46. The process of claim 44 wherein said inlet and outlet openings are arranged in a common surface of said holder.

47. The process of claim 45 wherein said inlet and outlet openings are arranged in a common surface of said holder.